

RIVER STAGES AND FLOODS

By BENNETT SWENSON

RELIEF from drought conditions in the Eastern States and record-breaking floods in the James and Roanoke River Basins in Virginia were dominant features during September. Heavy rains near the middle of September along the North Atlantic Coast associated in part with a severe hurricane passing up the coast were followed by heavy rains of unusual intensity in Virginia.

Over the country as a whole, precipitation during September was above normal in most of the Atlantic and East Gulf States, and in Tennessee, Kentucky, West Virginia, Michigan, Arizona, New Mexico, and Washington, and below normal in the remainder of the country. The precipitation pattern during September was almost an exact reversal of that which has persisted since April except in the northern Ohio Basin where Indiana and Ohio continued well below normal in September. Flooding was confined mainly to the middle Atlantic coast drainage, Kansas and Texas.

Atlantic slope drainage.—Generally the streams in the drainage area continued to subside slowly at abnormally low levels until September 12 when a series of heavy rains produced moderate rises. Unusually heavy rains on September 17–19 in southern and central Virginia resulted in record-breaking floods in the James and Roanoke River Basins, causing considerable crop loss and property and highway damage.

Generally heavy rains during the period September 12–15 preceded and accompanied the passage of a severe hurricane along the Atlantic coast from North Carolina northward. (A complete report of the hurricane is given in another section of this Review.) On September 12 and 13 rainfall amounts of about 2 inches occurred along the Atlantic coast from Virginia northward. On the morning of September 14, the hurricane passed over Cape Hatteras, N. C., was centered 12 hours later just south of Long Island, and on the morning of September 15 it was located a short distance south of Eastport, Maine, having passed over Boston, Mass., about midnight. The rains associated with this storm amounted to as much as 5 inches from New Jersey to New England. Because of the depleted state of the ground moisture prior to the storm only moderate rises resulted from these rains and floods did not materialize.

On September 17–18 a persistent high-pressure area centered over northern New England produced a deep current of easterly and south-easterly winds at the surface and aloft over southern Virginia. This strong convergent flow, together with orographic lifting, resulted in exceptionally intense rains along the foothills of the western Piedmont section east of the Blue Ridge. The heaviest precipitation was confined to an area from Charlottesville, Va., southward to Randolph, Va., and westward to Balcony Falls, Va.

The center of maximum rainfall appears to have been in the vicinity of Covesville, Va., where unofficial measurements indicated more than 18.5 inches. At Rockfish, Va., an official observing station, 14.26 inches of rain was recorded. Records from this station show that from 4 p. m. to 6:30 p. m. September 18 the intensity was about 2.6 inches per hour and from 6:30 p. m. to 10 p. m. the rate averaged 1.1 inches per hour. Previous to 4 p. m. the rain was light. Other rainfall totals for the storm period, September 17–19, are as follows: Charlottesville, Va., 10.97 inches; Afton, Va., 10.72 inches; North Garden, Va., 12.91 inches; Randolph, Va., 9.45 inches; Balcony

Falls, Va., 9.12 inches; and Tye River, Va., 6.81 inches. This rainfall, following the heavy rains of September 12–15, occurred on ground already well saturated and resulted in high run-off. As a result the tributaries of the James River from below Lynchburg to a point above Cartersville, Va., reached exceptionally high stages. The United States Geological Survey reported Hardware River rose about 10 feet above any previously recorded stage. Rainfall was relatively light in the headwaters of the James River and flood stage was not reached at or above Lynchburg. Downstream the river reached 26.0 feet at Scottsville, Va., and 34.4 feet at Bremono Bluff, Va., 0.2 foot and 0.9 foot, respectively, above the previous record of August 1940. At Columbia, Va., the river crested at 37.4 feet, 1.6 feet above the March 1936 flood, and at Cartersville, the crest of 29.6 feet exceeded the peak of the March 1936 flood by 0.8 foot. Since the rainfall was light from Columbia downstream, the crest leveled off rapidly as it moved downstream and the peak of 22.4 feet at Richmond was considerably below the crests of the March 1936 and April 1937 floods and about the same as the August 1940 flood.

Rainfall was relatively light in the headwaters of the Dan and Roanoke Rivers but was heavy over the Banister River and in the Randolph area. Stages in the Banister River exceeded the 1940 flood by about 3 feet and stages were high in the Roanoke River below Randolph, reaching a crest of 32.6 feet at Randolph, 12 feet above flood stage, and 48.6 feet at Weldon, N. C., 18 feet above flood stage. These crests were well below the 1940 flood.

A third storm, on September 29, with as much as 4 inches of rain in southern Virginia and in North Carolina produced another rise in the Roanoke River basin. Stages were high in the Dan River but the Roanoke River did not rise particularly high this time.

East Gulf of Mexico drainage.—Minor flooding near the middle of the month in the Conecuh and Choctawhatchee Rivers resulted from heavy rains on September 10, averaging 4.25 inches over that area. Crest stages of near 1 foot above flood stage occurred in the Conecuh River at River Falls, Ala., and in the Choctawhatchee River at Caryville, Fla. Damage resulting from the flooding was negligible, but excessive rains, amounting to 10.15 inches in 24 hours at River Falls, caused considerable damage to crops, roads, and highways.

Missouri River basin.—Light overflows during the month were confined to the Floyd and Little Blue Rivers where flood stage was exceeded by about 1 foot at James, Iowa, and Endicott, Nebr., respectively. The Blue, Solomon, and Kansas Rivers which overflowed in the latter part of August receded to below bankful early in September.

Ohio River basin.—Drought conditions continued in a narrow region extending from West Virginia to northern Indiana where streamflow averaged less than 30 percent of normal and at some stations stages reached the minimum of record. The Scioto River at Chillicothe, Ohio, fell to 0.8 foot during the month, the lowest stage of record since the beginning of observations in 1910.

In Kentucky and Tennessee, drought conditions which had prevailed during most of the spring and summer months were relieved by two periods of excessive precipitation, August 31 to September 1, and September 28 to 29. The second storm was general over most of both States and in the vicinity of Knoxville, Tenn., was especially intense. At Arlington, a few miles northwest of Knoxville, 8.57 inches of rainfall occurred in approximately 24 hours. Flooding from small streams and creeks

was extensive in Knoxville and vicinity, and Caney Creek above Rock Island, Tenn., and Stone River near Murfreesboro, Tenn., were in high flood.

Arkansas River basin.—On September 27–28 heavy rains occurred in the entire Neosho Basin, the Verdigris River above Independence, Kans., and in the Caney and Bird Creek Basins. Storm totals reached as high as 5 inches in the Neosho Basin below Iola, Kans., and about 4 inches in the Verdigris Basin. Runoff was relatively low and the resulting crests were generally below flood stages except in the Neosho River at Parsons and Oswego, Kans., where crests slightly above flood stage occurred on September 29.

West Gulf of Mexico drainage.—The severe flooding which began in the upper Nueces River during the latter part of August and reported in the August issue of the REVIEW continued in the lower portion during the first week of September. A crest of 26.65 feet, 11.5 feet above flood stage and the third highest stage of record, passed Cotulla, Tex., on August 30. The rise reached Three Rivers, Tex., on September 6 with a stage of 1.5 feet above flood stage.

Two additional rises in the lower Rio Grande followed the light to moderate overflows during the period August 24 to September 5. The first of these rises, from September 10 to 15, was caused by heavy rains over the San Juan River watershed in Mexico combined with high water present in the lower Rio Grande from the previous flood. The resulting crests were slightly lower than the earlier flood except at Brownsville, Tex., where a crest of 18.4 feet occurred on September 15, compared to 18.0 feet on September 5.

The second rise, from September 18 to 22, was caused by water coming down the main river from the El Paso, Tex., area. Flood stage was not reached from this rise except at Mercedes, Tex., with a crest of 21.8 feet. Very little damage resulted from these rises.

Colorado River basin.—A series of small but locally intense thunderstorms occurred in the vicinity of Thatcher and Safford, Ariz., during the period September 23–26, causing extensive damage to canal systems, highways, crops, and miscellaneous property in that area. The heaviest rains occurred on September 25 and rainfall totals for the entire storm period range from 4.69 inches at Hawk Hollow on the Fry Mesa Road at the foot of the Mesa, to as much as 7.65 inches in Thatcher. The Gila River, into which this area drains, showed no appreciable rise. Damage to property and crops resulting from the storms has been estimated at \$700,000, crop damage from hail accounting for \$125,000 of this loss.

FLOOD-STAGE REPORT FOR SEPTEMBER 1944

[All dates in September unless otherwise specified]

River and station	Flood stage	Above flood stages— dates		Crest ¹	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
James:	<i>Feet</i>			<i>Feet</i>	
Scottsville, Va.-----	20	19	20	26.0	19
Bremo Bluff, Va.-----	19	19	20	34.5	19
Columbia, Va.-----	10	18	21	37.4	20
Cartersville, Va.-----	16			29.6	20
State Farm, Va.-----	12	19	21	26.4	20
Richmond, Va.-----	8	19	22	22.4	21
Dan:					
Danville, Va.-----	11	{ 19	19	12.8	19
Clarksville, Va.-----	13	{ 30	(?) 22	18.5	21
Roanoke:					
Randolph, Va.-----	21	19	22	32.6	20
Weldon, N. C.-----	31	20	25	48.6	22
Williamston, N. C.-----	10	25	Oct. 13	12.9	27
Neuse:					
Neuse, N. C.-----	14	{ 21	24	16.0	22
Smithfield, N. C.-----	13	{ 30	(?) 25	13.8	24
Haw: Moncure, N. C.-----	20	30	(?)		
Catawba: Catawba, N. C.-----	8	30	(?)		
EAST GULF OF MEXICO DRAINAGE					
Choctawhatchee: Caryville, Fla.-----	12	13	16	12.8	14
Conecuh: River Falls, Ala.-----	35	11	11	35.7	11
MISSISSIPPI SYSTEM					
Missouri Basin					
Floyd: James, Iowa.-----	14	20	21	15.1	21
Solomon: Beloit, Kans.-----	18	Aug. 31	1	21.2	1
Little Blue:					
Endicott, Nebr.-----	11	{ Aug. 30	1	12.4	1
Hanover, Kans.-----	14	{ 21	21	12.3	21
Big Blue:					
Blue Rapids, Kans.-----	20	Aug. 30	1	16.6	Aug. 30
Randolph, Kans.-----	22	Aug. 30	1	25.0	Aug. 31
Kansas: Manhattan, Kans.-----	17	Aug. 31	1	23.7	Aug. 31
Missouri: St. Charles, Mo.-----	25	Aug. 30	1	17.9	Aug. 31
				26.25	Aug. 31
Arkansas Basin					
Neosho:					
Parsons, Kans.-----	22	29	29	22.6	29
Oswego, Kans.-----	17	29	30	18.2	29
WEST GULF OF MEXICO DRAINAGE					
Nueces:					
Cotulla, Tex.-----	15	Aug. 29	7	26.65	Aug. 30
Three Rivers, Tex.-----	37	6	7	38.5	6
Rio Grande:					
Rio Grande City, Tex.-----	21	Aug. 29	1	26.6	Aug. 30
Hildago, Tex.-----	21	{ Aug. 29	4	23.4	2-3
		{ 10	13	22.3	12
		{ Aug. 25	6	23.4	2, 4-5
Mercedes, Tex.-----	21	{ 10	15	23.2	13
		{ 21	22	21.8	21
Brownsville, Tex.-----	18	{ 5	5	18.0	5
		{ 14	15	18.4	15

¹ Provisional.² Continued at end of month.